

WHITMAN (R.)

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Flat-foot.



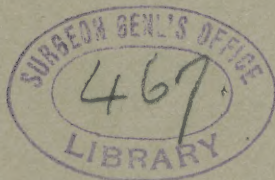
BY

ROYAL WHITMAN, M. D., M. R. C. S.,

Assistant Surgeon to Out-patients, Hospital  
for Ruptured and Crippled.

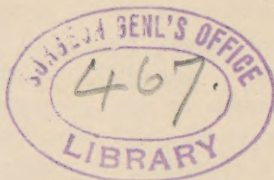
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THE  
RADICAL CURE OF CONFIRMED FLAT-FOOT.\*

BY ROYAL WHITMAN, M. D., M. R. C. S.,

ASSISTANT SURGEON TO OUT-PATIENTS,  
HOSPITAL FOR RUPTURED AND CRIPPLED.

THE term flat-foot is in some respects an unfortunate one, in that it does not correctly describe the affection, of which the important condition is abduction, and because most physicians and patients understand by flat-foot an inherited weakness which is to be endured or relieved by braces rather than to be actively treated and permanently cured.

I propose, therefore, to call your attention to some of the predisposing and exciting causes of weak foot, its progressive character and results, and to explain somewhat in detail the treatment which has been very successful in the cases falling under my observation.

Clinically, without attempting to enumerate all the varieties of this very common affection, cases may be divided into groups.

1. The cases known as weak ankles in weak or rhachitic children, or accompanying slight knock-knee.

\* Read before the Harvard Medical Society of New York, October 3, 1891.



2. The long weak foot seen in adolescence. These children are usually brought on account of prominence of the internal malleoli which are thought to be "growing out." The symptoms are awkwardness in walking, with fatigue on any overexertion. Here we find a prominent scaphoid, slight abduction and limitation of the movement of adduction, but usually no pain or tenderness on pressure. These cases are of importance, because in later years, under the increased work to which the feet are subjected, they may develop into the most confirmed and painful deformity.

3. Weak feet in older subjects, particularly women who are obliged to stand much of the time. In these cases the pain is very severe, but ceases when the feet are not used. There is usually but little spasm of muscles or limitation of motion—that is, the feet can be easily replaced in proper position, but are markedly flattened when weight is borne. There is great sensitiveness to pressure on the painful points, and often redness and swelling. This variety is very common, and is the form that most physicians associate with the term flat-foot.

4. The most interesting and important class with which this paper is chiefly concerned, usually seen in young adults. Here we find marked deformity and muscular spasm, so that the foot is quite rigid and can not be replaced in normal position. The arch is more or less flattened, but the important condition is the abduction—that is, when the feet are placed side by side there is a wide interval between the two great toes which the patient can not lessen, the power of adduction being limited or lost. In these cases the disability is very great, and the pain persists even when the feet are not actively used.

5. True flat-foot, or *pes planus*, which may be actually inherited or the result of *rhachitis* in infancy. There are

often no symptoms, and the condition need only be considered when pain is present.

It must be borne in mind that these varieties blend with one another, and that pain and discomfort do not in any sense correspond with the degree of deformity.

Flat-foot is considered by the writer as an acquired partial dislocation, caused by a disproportion between the weight to be sustained and the strength of the supporting structures. This broad definition includes everything that may weaken the foot or place it at a disadvantage in the performance of its functions, such as improper shoes and their consequences—corns, bunions, ingrown toe-nails, deformities of the toes, etc.—improper attitudes in activity and rest, local injury, or acquired or inherited weakness or disease; while overweight may mean long standing, laborious occupation, or simply increase in body weight. The examination of a large number of sufferers from flat-foot, a considerable proportion of whom were young and vigorous adults whose muscular development enabled them to engage in the most laborious of occupations, has confirmed me in the belief that the breaking down of the arch, in this class at least, is not the result of intrinsic weakness of muscles,\* or primary relaxation of ligaments,† or congenital deformities of bone,‡ or because there was some peculiar disease of cartilage,§ or primary muscular paralysis, atrophy,|| or spasm,^ or because the patient had worn high heels ◇—according to the various theories that have been advanced by writers on the subject—but because the feet, originally sufficiently strong, had been placed at a serious disadvantage in the performance of their functions.

As a clear understanding of the causes of flat-foot is essential to a proper apprehension of its successful treat-

\* The usually accepted theory.

† Tillaux and Lefort.

‡ Stokes. § Gosselin. || Sayre. ^ Duchenne. ◇ Mayo-Collier.

ment, I shall try to explain what these disadvantages are and how they may be overcome and avoided.

*Attitudes.*—The attitude of adduction is the strong position, the attitude of abduction the weak one.

The elastic walk of a barefoot child illustrates the first, a soldier presenting arms the second position. In the first instance the feet are under the control of the adductor muscles, and the ligaments are relieved from strain; in the second, or attitude of rest, the ligaments bear the greater part of the weight. Thus adduction, which implies muscular activity, is the most favorable attitude for supporting weight; abduction, the most unfavorable. A glance at the anatomical structure of the foot will make this clear. In a general way it may be divided into two arches—an outer or strong arch, solidly braced and usually in direct contact with the sole of the shoe, composed of the os calcis, cuboid, and two outer metatarsals; and an inner and weaker arch, made up of the os calcis, astragalus, scaphoid, three cuneiform and three inner metatarsal bones, directly under control of the adductor muscles, whose strength and activity are essential to its support. Again, the astragalus is perched upon the os calcis, “like a lady on horseback,” at a point somewhat internal to its base, so that the weight of the body transmitted through it tends to tip the os calcis over to the inner side, allowing the astragalus to slip downward and inward. A certain amount of inward rotation of the astragalus as the foot broadens and flattens under weight is normal,\* but before it becomes excessive the strong adductor muscles contract, the great toe is braced to resist the lowering of the arch, and the weight is thrown toward the outer side of the foot.

The more the feet are habitually turned outward in

\* Whitman. Observations on Forty-five Cases of Flat-foot. *Boston Medical and Surgical Journal*, June 14, 1888.



standing and walking, the greater the strain upon the arch ; the more they are turned inward toward the line of the walk, the greater the protection of the weaker side of the foot. To illustrate, if the feet in walking are pointed straight ahead in the line of the walk, flexion and extension at every step, or muscular activity, is essential, because the toes, being in front of the body, must be walked over, and the weight of the body lifted at every step by muscular contraction. If they are turned outward, the weight is first thrown upon the heel, then directly upon the weakest part of the foot, and we have the passive, inelastic walk of the weak, aged, and flat-footed. If the foot is to be actively used, it is essential that its component parts should be in healthy condition ; thus it will be understood how corns, bunions, ingrown toe-nails from improper shoes, weakness from injury, or the result of gout or rheumatism, may make active flexion of the foot painful so that it is avoided by turning the toes outward. I have also shown in a former paper that the faulty position of the feet is habitual in a very large proportion of individuals.\* Muscles are weakened by disuse and improper shoes, and under the influence of overwork, injury or disease, overstrained arch and later flat-foot may develop. To illustrate this point Fig. 1 and Fig. 2 have been drawn from life. Fig. 1 represents the passive walk with eversion of the feet, the weight of the body falling on the inner or weaker side. Fig. 2 shows the proper attitude, the muscular activity and protection of the arch being very apparent. The subject of this paper being the treatment of confirmed flat-foot, I shall briefly describe the anatomical conditions which may be present in such a case, with its symptoms, and then the steps by which a radical cure may be accomplished.

In confirmed flat-foot we shall find an exaggeration of

\* *Transactions of the American Orthopædic Association*, i.

the condition before indicated: the os calcis tipped over to the inner side and rotated inward; the astragalus rotated inward and dislocated downward and inward; the entire

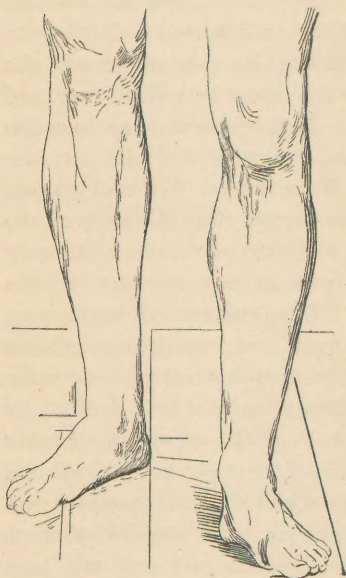


FIG. 1.



FIG. 2.

fore-foot, everything in front of the medio-tarsal joint, thrown downward and outward; the foot is as it were broken in the center. The arch has to a great extent disappeared; there is a marked projection on the inner side caused by the displaced astragalus and scaphoid, while the foot is lengthened and broadened in shape.

The overworked peronei muscles are in a state of spasm or are actually shortened, and resist any attempt at reduction of the deformity. The adductors have lost their power, and, in addition, there is usually a loss of function of the



toes with callosities and corns. Often there is more or less swelling of the feet with excessive sweating.

Dissection \* shows weakened and atrophied muscles, overstretched ligaments, changes in the bones with the formation of new facets, and other evidence of the chronic inflammation which has accompanied the gradual progression of the affection. Such changes are, however, the result of many years of neglect, and illustrate the importance of early diagnosis and treatment.

The affection is easily recognized. Persistent pain, weakness, and discomfort about the arch of the foot, increased by standing or walking, particularly on going up or down stairs, which necessitates an extra exertion of the affected joints, with tenderness on pressure at the junction of the astragalus and scaphoid, are perhaps the earliest symptoms. In some cases the arch may appear perfectly normal, while in others the foot is entirely flat.

The usual symptoms, some of which are always present, are as follows :

1. The peculiar inelastic walk, the weight being thrown upon the heels, the feet turned outward to avoid activity ; as patients express it, "the feet have lost their spring."

2. The deformity—the flattening of the arch, and the projection on the inner side of the foot, when weight is borne—a deformity which later becomes permanent, from muscular spasm, contraction, and shortened ligaments, with inflammatory adhesions between the bones.

3. Pain in the feet, with local tenderness on pressure, referred to the following points in order of frequency :

1. The astragalo-scaphoid junction.
2. Below the external malleolus.

\* Symington, *Journal of Anatomy and Physiology*, October, 1884. Humphrey, *Lancet*, March 20, 1886. Stokes, *Annals of Surgery*, October, 1885. Von Meyer, *Ursache und Mechanismus der Entstehung des erworbenen Plattfusses*, 1883. Hueter, *Grundriss der Chir.*, 1882.

3. The dorsum of the foot.
4. The center of the heel.
5. Beneath the great toe joint.

The pain is often reflected up the inner or outer side of the leg to the knee or hip.

4. Extreme stiffness of the feet after sitting, or on rising in the morning, or cramps at night in the feet or calves, symptoms usually associated with the more advanced cases, indicating, I believe, beginning changes in the bones, with the formation of new facets. To illustrate, two patients have recently consulted me who refused to sit down in my office because the effort to stand was so painful after the momentary relaxation of the muscular tension.

In considering the question of early diagnosis, the intermittence of symptoms should be borne in mind; thus, a weak foot when subjected to overstrain becomes painful. After a few weeks' rest the pain ceases, to recur several months later under similar irritation. There are, too, rheumatic symptoms in a weakened foot; the pain, often accompanied by redness and swelling, is worse in damp weather, or the affection may be the result of weakness following true rheumatic inflammation, although this is comparatively rare. As flat-foot is so constantly mistaken for rheumatism, it would be well to remember that rheumatic inflammation is rarely confined to one member or joint, that persistent pain in the feet is almost always of local origin, and that local treatment for local pain and deformity is always in order, while medicinal treatment, except for the rest of the affected parts, which may be advised, is worse than useless, as it postpones the recognition and proper treatment of the true affection. If this proposition, that persistent local pain demands local examination and treatment, were accepted, many sufferers might be relieved from years of pain and discomfort.

In considering the treatment of a case of flat-foot, the important question is this: Can it be replaced in proper position? If it can—that is, if its movements are free and unembarrassed, not limited by muscular spasm or inflammatory adhesions—the treatment is very simple. An efficient support, a proper shoe, an avoidance of faulty positions, with exercises for strengthening the weakened muscles, will at once relieve the patient. If, however, the reduction of the deformity by manipulation is impossible, it should be treated as any other dislocation should be—adhesions should be broken up and the deformity reduced. This variety, which I have included in the fourth class, is the most interesting and important, because the patients are usually young adults; the deformity is extreme; the affection rapidly progressing; the patients are almost completely disabled; the symptoms are so urgent that they are very amenable to treatment, and the results are most satisfactory. Excessive muscular spasm and rigidity in a young person I have come to look upon as a very favorable indication, as it shows muscular strength and integrity of bone—the same distinction that one might make between a recent dislocation with the accompanying pain and the passive acceptance of the situation in a displacement of long standing. A radical cure is possible in all recent cases of flat-foot, and relief of pain and, to a great extent, of deformity may be assured in every case.

Some writers hold out the forlorn hope that when the deformity is complete—that is, when the astragalus rests upon the sole of the shoe—pain ceases. I need only mention the fact that I have treated patients after twenty years of continuous and increasing discomfort. The treatment of this class of cases is conducted on the following principles:

1. Forcible reduction and overcorrection of the deformity.



2. A temporary support to prevent relapse.
3. A proper shoe.
4. Manipulation to stretch contracted and shortened tissues.
5. Exercises to strengthen weakened muscles.
6. A re-education of the patient in the proper manner of walking and supporting weights.

In brief, the application of the simplest surgical princi-

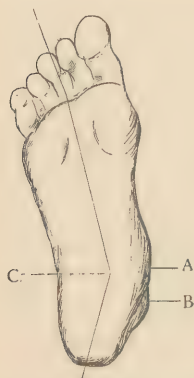


FIG. 3.—Flat-foot before operation. A, the projection of the displaced astragalus and scaphoid; B, the inner malleolus; C, the mediotarsal joint, showing the outward displacement before, the inward rotation behind, this point.

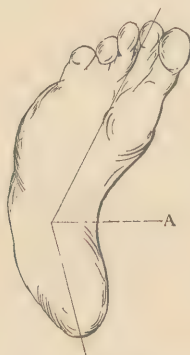


FIG. 4.—The over-corrected foot, with the reversal of the lines of displacement.

ples. Under ether, the foot is forcibly moved in all directions to break up adhesions, and is then forced into a position of extreme adduction or equino-varus and retained there by a well-padded plaster bandage. Although great force is sometimes used, the after-symptoms are usually slight, and the patient, if he desires, is allowed to walk about on the plaster bandages on the following day. In about a week, or earlier, if there is no pain in the feet, the bandages are

removed and plaster casts are taken for the support which is to be used.

Casts are easily and quickly made in the following manner: Seat the patient in a chair; in front of him place another chair of equal height; on it lay a thick pad of cotton batting and cover it with a square of cotton cloth. Put about a quart of cold water into a basin with a tablespoonful of salt; sprinkle plaster on the surface, stirring until the mixture is of the consistence of thick cream, then pour it upon the cloth. Flex the patient's knee and allow the outer side of the foot, previously oiled, to sink into the plaster, raising the edges of the cloth until rather more than one half the foot is covered. When this is hard, spread vaseline on its upper surface, and, having mixed a smaller quantity of plaster, cover the exposed surface of the foot; the toes need not be included. When hard, the two halves are removed and their inner surfaces oiled. They are then bandaged to one another and the interior filled with plaster of the same consistence as before. When the outer shell is removed, we have a reproduction of the foot ready for further manipulation. This consists in changing the cast with the exercise of a certain amount of judgment, so that it may resemble a perfect foot—that is, to scrape away the projection on the inner side if any remains, and to deepen the inner and outer arches. Several years ago I was in the habit of making the brace on an actual reproduction of the foot, but experience showed that it was possible, by the treatment to be described, to still further overcome deformity which could not be corrected by the forcible reposition under ether. When completed, the casts should stand squarely on the table with no inclination to either side; they are then sent to the founder to be reproduced in iron.

The feet are, if the case is one of long standing, again placed in adduction and the plaster bandages reapplied.

No anæsthetic is necessary, as the previous overstretching, with the subsequent rest, has to a great extent removed the resisting muscular spasm. In from one to three weeks, according to the judgment of the surgeon, the bandages are removed and active treatment begun. The flat-foot on which forcible over-correction has been performed is now, although in good position, stiff, and all its movements are restricted and painful, and if the patient is allowed to go about without support and further treatment, a recurrence of the deformity is inevitable.

The subsequent treatment is carried out with the aim of regaining free and painless movement in every direction, particularly in adduction. The foot is first immersed for ten minutes in hot water, afterward vigorously massaged, especially about the dorsum, and is then slowly forced into a position of adduction. This manipulation, first described by me in the *New York Medical Journal* of October 11, 1890,\* has gradually assumed greater importance, and is now considered an essential for the successful treatment of the affection. It is conducted as follows: The patient is seated in a chair; the surgeon stands in front of him. Let us suppose that the left foot is to be adducted or, as patients express it, twisted. The surgeon places the foot between his knees; his left hand encircles the heel, the fingers grasping the projecting os calcis and tendo Achillis; the ball of the palm lies against the mediotarsal joint on the inner aspect of the foot; the right hand grasps the outer side of the fore-foot and toes; then by steady pressure of the thigh muscles the fore-foot is forced inward over the fulcrum formed by the projecting palm which lies upon the left knee, the fingers holding the heel steadily in place. This inward twisting is at first resisted by a mixed voluntary and involuntary muscular spasm, which gradually gives way un-

\* Persistent Abduction of the Foot.



der steady pressure. When the limit of adduction has been reached, the foot is firmly held until all pain has subsided, when the patient is instructed to make voluntary movements while the foot is in the corrected position, flexion and extension of the toes, and to contract the flexor muscles of the foot. The foot is then released, and twenty minutes of voluntary exercise follow, and at intervals during the day the patient, by active muscular efforts and passive motion, constantly works to one end—namely, to regain the lost power of adduction—while once daily the inward twisting is performed by the surgeon. Under this treatment the pain and stiffness rapidly disappear, and the foot constantly assumes a better position. The results that can be attained by this treatment persistently carried out, even in cases of long standing and apparently hopeless deformity, are surprising. I wish to call your attention to the fact that forcible *over-correction* followed by persistent passive stretching of contracted tissues is quite different in



FIG. 5.—A, the astragalo-scapoid joint.

principle from the simple forcible correction of deformity with indefinite retention of the feet in plaster and silicate

bandages, as practiced by Roser, Lorenz, and Smith. Meanwhile the brace is made of thin steel.\*

It is molded on the iron cast while hot, and is then tempered so that it is unyielding under the weight of the body.

Its shape may be seen in the diagrams (Figs. 5, 6, and 7). A broad internal upright portion covers the astragalo-scapoid joint, the weak point of the foot; a molded arm reaches from the center of the heel to a point just behind the bearing surface of the ball of the great toe; an outer arm passes beneath the os calcis and cuboid bones, and upward slightly on the outer aspect

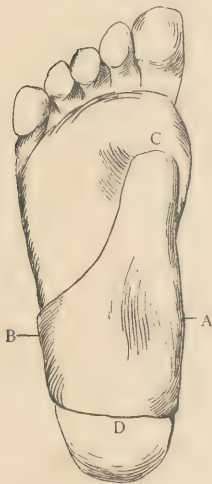


FIG. 6.—C, the great-toe joint; D, the center of the heel.

of the foot, which is thus held firmly in the brace, and can not slip away to the outer side, as is the case with braces which depend upon the shoe to hold the foot in position. As the patient is instructed in the proper walk, he throws his weight first on the outer side of the foot, thus pressing the external arm down against the sole of the shoe, a movement which at the same time causes the internal projection to press more firmly against the inner side of the foot. This pressure tends to turn the fore-foot inward, relieving the arch from weight. In addition, this brace differs in the following points from those with which I am familiar, in that it is an accurate adjustment to a cast of the corrected foot; that it, by the inward flange,

prevents abduction, a movement which precedes the lowering of the arch; that the brace is complete in itself and does not

\* The best sheet steel, No. 19 or 20 gauge, cut with the grain.

depend upon the shoe to prevent deformity ; that it is not in any way attached to the shoe, but retains itself in prop-



Fig. 7.—B, the calcaneo-cuboid joint.

er position—it may thus be changed from one shoe to another, and may be kept clean and free from rust ; that it allows the foot to rest upon its natural supports, the heel and the ball of the foot, provides support only to the weak points, and does not in any way restrict normal motion and activity, which are to be encouraged by insisting that the patient shall assume the proper attitude in walking. This brace is not a spring ; it is inelastic, as it is intended to hold the foot in normal position, not to allow a recurrence of previous deformity. Finally, it is comfortable ; the painful pressure on the sole of the foot, often complained of when simple arched supports are used, being absent.

It is nickel-plated or tin-plated and is then japanned. No covering is used, and, as it fits the foot perfectly, its presence in the shoe can not be detected.

The shoe to be recommended is one of the Waukenphast pattern, with a sole broad enough to support the foot, having an inward twist to allow room for the great toe. In advanced cases of flat-foot I usually build up the inner side of the sole after the method known as Thomas's, in order to



throw the weight more to the outer side while the foot is still weak. The patient is then allowed to go about his usual occupations, no restriction being placed upon walking, provided the proper attitude, with but little divergence of the toes, is assumed.

The entire treatment described has consumed on an average three weeks. Daily exercises are still continued with the stretching until the movements of the foot are absolutely free and unembarrassed. One of the best gymnastic exercises for strengthening the feet is to raise the body on the toes twenty or thirty times, morning and night, as recommended by Ellis (*Lancet*, September 26, 1885). It will, however, be remembered that the best possible exercise is a proper walk. In an ordinary case the braces can be dispensed with in about six months, when a cure may usually have been accomplished, although all symptoms have disappeared long before.

The limits of this paper have simply allowed me to outline this method of treatment; many aids in gymnastic and local treatment will suggest themselves. The essentials for entire success are a complete reduction of deformity, a complete recovery of the lost power of adduction, an increase in muscular strength and activity, and an avoidance of improper attitudes in standing and walking. The success that follows persistent treatment of confirmed flat-foot is most gratifying, and my experience justifies me in asserting that no affection of equal importance can be so easily relieved and permanently cured.

In conclusion, it may be well to mention the operative treatment of flat-foot. The operation described by Golding Bird,\* Ogston,† and, with modifications, ‡ by various

\* *Guy's Hospital Reports*, 1882.

† Ogston. *Lancet*, January 26, 1884.

‡ Hare. *Lancet*, November 9, 1889.

others, consists essentially in destroying the mediotarsal joint by producing an ankylosis between the astragalus and scaphoid bones. I have not seen a sufficient number of cases to judge of its merits; the few that I have seen presented a stiff but useful foot with a partial relief of pain and deformity. Most of the reported operations have been performed on children and young adults, the most favorable class for cure with preservation of normal joints, a result which must be vastly superior to any relief that may be obtained by an operation which aims at the destruction of the most important joint of the foot. The essential difference between the two methods of treatment is this: The one recognizes the fact that a foot subjected to the predisposing and exciting causes outlined may, by slow progression, reach a stage of extreme deformity; and that the affection is curable by a reversal of the conditions under which it developed. The other assumes the impossibility of cure and endeavors to relieve the symptoms by substituting an ankylosed joint for muscular strength and activity. The first method requires patience, persistence, and the intelligent co-operation of the patient. The second requires nothing but the ability to perform a cutting operation. There is, however, a class of patients in most destitute circumstances, with no shoes, no money, no homes. Here hospital treatment is a necessity, and hospital treatment for flat-foot at least implies an operation. For this class the operation—and, in my opinion, the only cutting operation which should ever be performed for flat-foot—is the supra-malleolar osteotomy of Trendelenburg,\* first performed here by Dr. Willy Meyer.† The object of the operation is the production of artificial bowlegs, thus throwing the weight off the arch to the outer side of the foot. Dr. Meyer's

\* *Archiv für klin. Chir.*, xxxix, 4.

† *N. Y. Med. Journal*, May 24, 1890.

results have been very satisfactory. The disadvantages of the operation are the time that is necessary for consolidation of the divided bones and the very noticeable bowing of the legs, which would preclude its use in patients of more æsthetic temperament. I should suggest that the breaking up of adhesions and over-correction of the deformity would be a useful preliminary to the operation. Finally, I may again urge the importance of an early recognition and intelligent treatment of this affection which has such an important influence on the future prospects of the young, and in later years may reduce the sufferer and those dependent on him to the most extreme destitution.

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